DOCUMENT RESUME

ED 275 016 CS 505 395

AUTHOR Allen, Richard L.; Waks, Leah
TITLE The Dimensionality of Commonly Employed Mass Media Exposure Measures.
PUB DATE 86
NOTE 30p.; An earlier version of this paper was presented at the Annual Meeting of the International Communication Association (36th, Chicago, IL, May 22-26, 1986). Funding for research was provided by a National Institutes of Health Biomedical Research Support Grant to the University of Michigan.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Error of Measurement; Mass Media; *Measurement Objectives; *Media Research; Newspapers; Periodicals; Radio; Research Problems; Television
IDENTIFIERS *Media Exposure

ABSTRACT

A study examined whether mass media exposure is a unidimensional, bidimensional, or multidimensional construct as reflected in commonly used indicators of exposure. Telephone interviews were conducted with 534 households to determine media exposure. A structural equation model was proposed to account for the dimensionality of mass media exposure, the relationship among the identified dimensions, the reliability of the indicators, and the measurement errors involved. Results indicated that the hypothesized multidimensional construct provided the best fit. They also showed that the commonly used indicators of mass media exposure had a statistically significant relationship with their respective constructs, though the indicators exhibited both random and nonrandom measurement error. The results of this study suggest that many of the contradictory results relating mass media exposure to various outcome variables may be due to varying degrees of measurement error, and that more attention should be placed on the assessment of the extant measures of mass media exposure and the development of more adequate ones. A three-page list of references and four tables of data are included. A figure illustrates the multidimensional structure of mass media exposure. (JD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

The Dimensionality of Commonly Employed Mass Media Exposure Measures

Richard L. Allen and Leah Waks

University of Michigan

Department of Communication

2086 Frieze Building

Ann Arbor, Michigan 48109

(313) 764-3226

Authors' Note: Richard L. Allen (Ph.D., University of Wisconsin) is an Associate Professor in the Department of Communication at The University of Michigan. Leah Waks is a doctoral student in the Department of Communication at The University of Michigan. An earlier version of this paper was presented at the 1986 Annual Meeting of the International Communication Association. This research was supported by grant # 2 SO7RR07050-20 from the National Institutes of Health Biomedical Research Support Grant to the Vice President for Research of The University of Michigan.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Richard L. Allen

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

ED275016

CS 505 395

ABSTRACT

This study explored the question of whether mass media exposure is a unidimensional, bidimensional or multidimensional construct as reflected in commonly used indicators of exposure. A telephone survey was conducted of respondents, 18 and over, in a suburban area of a nearby metropolitan center. Using structural equation modeling (LISREL), which takes into account measurement error, the results indicated a good fit was provided by a model that hypothesized mass media exposure to be a multidimensional construct. Also, the commonly used indicators of mass media exposure had a statistically significant relationship with their respective constructs; however, the reliability of these indicators varied considerably. Finally, the indicators exhibited both random and nonrandom measurement error. It was concluded that many of the contradictory results relating mass media exposure to various outcome variables may be due to varying degrees of measurement error, and that more attention should be placed on the assessment of the extant measures of mass media exposure and the development of more adequate ones.

Media exposure and its various derivatives, such as television exposure, public affairs exposure and message discrimination, are perhaps the oldest and most researched subjects in mass communication. These subjects have remained of interest because of their hypothesized impact upon (and relationship with) beliefs, attitudes and behaviors. While many have suggested that the mass media have only a limited impact, the trend is to assign to them a much more influential role (Roberts & Bachen, 1981). For example, Gerbner (1967) hypothesized that the mass media, especially television, because of the systematic character of its messages and its consistency over time, have powerful effects and are a dominant force in molding individuals' view of the world. Similarly, but with greater theoretical precision, Ball-Rokeach and DeFleur (1976) maintained that media messages have the potential to achieve a broad range of cognitive, affective and behavioral effects when media systems serve a variety of unique and central functions.

A researcher wishing to test these and related hypotheses faces a number of difficulties. A central problem is the conceptualization and the measurement of mass media exposure (Allen, 1981; Allen & Taylor, 1985; Miller, 1974, 1977; Salomon & Cohen, 1978).

Few researchers have called attention to the importance of proper measurement instruments and to the large degree of measurement error that may exist in commonly used mass media exposure measures. The cost of such neglect may be the variety of conflicting findings as exemplified in the media agenda setting area. The findings of these studies are often contradictory with respect to whether the media actually tell people what to think about. And, if so, which medium, television or print, has the dominant effect. In a review of this body of literature, Weaver (1984) pointed out that the key studies provide mixed results, but he attributed such a situation to the kind of data used, the measurement of the outcome variables, and the design of the study. However, he overlooked the possibility that the differences among the studies may be due to different conceptualizations of media exposure, the use of different measures of newspaper and television exposure, and their associated measurement error.

A convincing case may be made that these differences in results are, to a large degree, a consequence of various degrees of measurement error, the identification of which is facilitated by adhering to the distinction between the theoretical concept and the measured variable. Similar diversity will accompany other analyses of causes and consequences of media exposure until some of the measurement issues are addressed.

The crux of the concept/measurement problem is often a question of dimensionality: Is a given theoretical construct unidimensional, bidimensional or multidimensional? The question of dimensionality is crucial to theory because different dimensions of a construct may be expected to have different causes and consequences. In research, measurement operations that do not accurately reflect the dimensions of a construct yield ambiguous results. If a construct is multidimensional, a unitary measure may tap only one dimension or may confound a number of partially countervailing dimensions. Conversely, an attempt to use separate measures for a unidimensional phenomenon will result in a futile battle with multicollinearity. In sum, the dimensionality question is crucial to the integration of theory and research, because it draws attention to the theoretical assertions in any operational definition and, therefore, emphasizes the need to incorporate explicit measurement models in causal models (Blalock, 1982). It is puzzling that information about the dimensional structure of mass media exposure measures has been consistently ignored in many studies. Researchers continue to calculate simple sums of all the commonly used items of these constructs and to interpret research results as if the measures were unidimensional.

The purpose of this paper is to explicate the dimensional structure of widely used measures of mass media exposure. The measures were chosen based on a perusal of the literature, and the extent to which they corresponded to our theoretical definition of the exposure constructs. A structural equation model is proposed to account for the dimensionality of mass media exposure, the relationship among the identified dimensions, the reliability of the indicators, and the measurement errors involved.

Conceptualization of Mass Media Exposure

When conceptualizing mass media exposure, certain distinctions need to be made: first, the difference between a medium and a mass medium. In the former case, any device that carries messages between people is a medium, which includes, for example, the telephone, and the billboard. What makes a medium a mass medium is its ability to carry messages not just from one person to another but from one person to a large number of others (Jeffres, 1984). Thus, the mass media may be said to be composed of television, radio and movies (the electronic media) and newspapers, magazines and books (the print media).

A number of researchers have gone beyond this nominal definition of mass media and have outlined the various attributes and characteristics of each mass medium. Some have suggested that structure and format of the different media may affect the meaning derived from them. As a consequence, it may be useful to conceive of the mass media as existing on different theoretical dimensions. For example, Chesebro, (1984), focusing on print vs. electronic media, outlined a media-cognition relationship. Citing recent neurological evidence, he stated that specific media are linked to particular modes of understanding. Reading, associated with the print media, generates predominantly analytical, logical and sequential modes of understanding. Televised and musical formats generate predominantly synthesized, holistic pattern-recognition as modes of understanding. Relatedly, Wachtel (1978, p. 376) has pointed out that every medium has a bias toward space and time. Each, in its own way, imposes an order and coherence on the world. This is not only true of language, but of all the new technologies and techniques that present experience in symbolic form.

While these above insights are useful, arriving at a theoretical definition of mass media exposure is still a complicated task. Acknowledging the various definitions of this construct, mass media exposure is defined here as a social situational factor involving choosing among messages and among activities. To be exposed to the mass media is to be in a situation where a decision is made--either directly or indirectly--to watch, to listen or to read instead of engaging in some other activity. Because of the different attributes of each medium, it is assumed that each medium will affect people differently, and they will respond to each differently. The prediction that there are different derivatives of mass media exposure is an empirical manifestation of this idea.

Model Specification[1]

Figure 1 presents a diagram of the proposed structural model of

---

Figure 1 about here

---

mass media exposure. Here, the η s (etas) are the four dimensions or factors. The ζ s (zetas) indicate errors in the equations. The λ s (lambdas) are the factor loadings or the coefficients of indicators regressed on each unobserved dimension. To establish the unit of measurement for each factor, the factor loading of one of its indicators is constrained to 1. Last, the ε s (epsilons) indicate measurement errors associated with the observable indicators.

As shown, mass media exposure is assumed to consist of four dimensions: television exposure (η_1), with three observable indicators--y_1 through y_3, newspaper exposure (η_2), with three observable indicators--y_4 through y_6, radio exposure (η_3), with three observable indicators--y_7 through y_9, and magazine exposure (η_4), with two observable indicators--y_{10} and y_{11}. The specific items are presented in the next section.

Several empirical implications are embodied in this model specification. The loadings (λ s) are assumed to be positive and statistically significant. Because measurement errors (ε s) are assumed in the observed indicators, the variance of measurement errors should be significant. Also, the correlated errors in the equations [i.e., cov (ζi, ζi)=0] are expected to be nonsignificant, since it is assumed that the factors are independent.

Study Design

A telephone survey was conducted in the suburbs of a large metropolitan area from June through September, 1984. The sampled telephone households interviewed were selected using the random digit dialing methodology. A two-stage random dialing procedure (see Waksberg, 1978) was employed to increase the proportion of randomly generated phone numbers which led to a household unit. This procedure began with a random generation of a sample of telephone numbers, but the actual identification of sample telephone numbers was performed in two stages. First, a set of primary sample numbers was selected. Then, for each primary number that was a working household number, secondary selections were made within the same hundred series as the primary number. Under the sample design, each phone household in the specified study area had an equal probability to

be contacted for interview. Of the 800 eligible households, 534 interviews were completed, resulting in a 65% response rate.

The latent variables used in the following analyses are measured as follows:

Television Exposure

1) Time spent with television yesterday: measured as the amount of time, in minutes, spent watching television. This measure was recoded into hours.
2) Frequency of watching television: measured, on a seven-point scale, as the frequency of watching television.
3) Attention to nonnews television: measured, on a seven-point scale, as the amount of attention paid to nonnews and nonpublic affairs television content.

Newspaper Exposure

1) Frequency of daily newspaper reading: measured, on a seven-point scale, as the frequency of reading the daily newspaper.
2) Attention to the front page section of the newspaper: measured, on a seven-point scale, as the amount of attention paid to the front page news section of the newspaper.
3) Frequency of reading the news section of the newspaper: measured, on a seven-point scale, as the frequency of reading the news section of the newspaper.

Radio Exposure

1) Time spent with radio: measured as the amount of time, in minutes, spent listening to the radio on an average day. This measure was recoded into hours.
2) Frequency of radio listening: measured, on a seven-point scale, as the frequency of listening to radio on the average day.

3) Attention to nonnews radio: measured, on a seven-point scale, as the amount of attention paid to nonnews and nonpublic affairs content on the radio.

Magazine Exposure

1) Time spent with magazines: measured as the amount of time, in minutes, spent reading magazines in an average week. This measure was recoded into hours.

2) Attention to magazines: measured, on a seven-point scale, as the amount of attention paid to magazine content.

These indicators are commonly used to represent the latent constructs of television, newspaper, radio and magazine exposure (see McLeod & McDonald, 1985). Although many investigators have used only a single item to represent these latent constructs, here a multiple indicator approach was used to better capture the different aspects of these abstract concepts and, empirically, to allow us to estimate the model and, thus, the research questions embodied in it. Also, it should be noted that these indicators are composed of a number of medium-specific and content-specific measures. With the exception of the magazine construct, which has only medium-specific measures, all the constructs have both types.

The covariance matrix was used in the analysis. The matrix of these eleven indicators are presented in Table 1.

Table 1 about here

Results

The hypotheses that the 11 indicators are measuring their respective constructs are evaluated with confirmatory factor analysis. Confirmatory factor analysis (LISREL) allows the researcher to specify the relationship

between unmeasured variables and their indicators and to see if the hypothesized structure is consistent with the data. In this case, it is hypothesized that the unmeasured variables are driving or influencing their indicators.

Several assumptions are implied when LISREL is applied. First, given the proposed model, measurement errors, εs, are assumed to be independent from ηs, and ζs. Further, measurement errors are assumed to be uncorrelated among themselves. This assumption is later relaxed to allow for correlated measurement errors. Third, the observed indicators, ys, are assumed to be distributed multinormally. Under the aforementioned assumptions, the goodness-of-fit of the hypothesized specification (see Figure 1) can be evaluated by examining the overall and component fit measures. When a certain measurement formulation provides an acceptable fit to the data (the overall or summary fit), the various components of the model may be evaluated.

Our analytical strategy was to explore three different models: the null model of no structure, the model that assumes that four underlying dimensions account for the covariance among the eleven indicators (model 1), and finally, the model that incorporates model 1, but with correlated errors between the indicators (model 2). Table 2 presents a summary of our fitting process.

Table 2 about here

One measure of importance gauges the degree of structure in the covariance matrix by estimating a model that assumes no structure, the null model. That is, the hypothesis that the covariances found in Table 1 could occur by chance even if the true covariances are zero.

To test this hypothesis a model was estimated that allowed for each indicator to have a variance of 1, but all covariances to be equal to

zero. The overall fit of such a model was measured by a X^2 variable. The probability level (p) of the X^2 is the probability of getting a X^2 value larger than the value actually obtained, given that the hypothesized relationship is true. Hence, small values of p correspond to a poor fit (Joreskog, 1969). The X^2 for the no structure or null model is 777.220 with 55 degrees of freedom. The probability level is less than .0001. This is a strong indication that the hypothesis that these items are only randomly related is false.

Next, the model, which assumes that our four underlying dimensions are responsible for the covariance among the eleven indicators, was tested (i.e., Figure 1). Several measures of goodness-of-fit have been proposed for models of this type. One is the likelihood ratio test. With a X^2 distribution, we assessed the probability that the observed covariance matrix could have been generated by the hypothesized model. According to this criterion, the hypothesized model (i.e., model 1) did not fit the data well. It was, however, an improvement in fit over the null model. This is illustrated by the substantial difference between the X^2 associated with both models. The difference in X^2 is 657.38 (777.220-119.840) which is significant at less than the .001 level with 17 degrees of freedom.

Although model 1 provided an improvement in fit over the null model, it was possible to derive another model that has a better fit than model 1. This entails loosening some of the restrictions in model 1. A number of empirical techniques for selecting which restrictions to relax have been suggested (Long, 1976), but alterations based on substantive or theoretical knowledge are more desirable (Saris, dePijper & Zegwaart, 1979). It was decided that the assumption of independent measurement error be relaxed, which was considered to be more realistic. By doing this,

we would be able to improve the goodness-of-fit. Three pairs of correlated errors (ε's) were introduced into model 1^2. Comparing this restricted model (model 2) to model 1, a X^2 difference of 43.41 is obtained ($p < .001$). Thus, the addition of the correlated measurement error led to a significant improvement in fit.

The improved model with correlated measurement error was assessed. Using the likelihood ratio test (X^2), model 2 did not fit the data well. Given that the likelihood ratio test is very sensitive to sample size, for large samples almost no theoretical structure will adequately account for the observed covariances (Bollen, 1985). Therefore, a relative X^2, the ratio between X^2 and its degrees of freedom, was used. This index, presumably, takes sample size into consideration and a ratio of approximately five or less (Wheaton, Muthen & Summers, 1977), and preferably 3 or less (Carmines & McIver, 1981) have been recommended. Applying this measure of fit, model 2 exhibited a good fit with a relative X^2 of 2.184.

Another summary measure of fit that was employed is called the Goodness-of-Fit Index (GFI). It indicates the relative amount of variance and covariance explained by a model, and its values range from 0 to 1. The GFI for model 2 was .961, indicating a good fit.

Since the GFI does not adjust for degrees of freedom of a model, an Adjusted Goodness-of-Fit Index (AGFI) was developed (Joreskog & Sorbom, 1981). With the same range as the GFI, model 2 had an AGFI of .926, not substantially different from the GFI.

The fifth summary measure used to evaluate model 2 is the Critical N(CN). This estimate allows one to assess the fit of a model relative to an identical hypothetical model estimated with different sample sizes. While there are no agreed upon guidelines for assessing the magnitude of CN, Hoelter (1983) suggested that a CN value beyond 200 indicates that a

particular model adequately reproduces an observed covariance structure. In our case, the CN value is 218.

The final summary measure of fit was the Coefficient of Determination. It measures how well the y variables or indicators serve as measures of the latent variables η. As with the other measures presented, more experience is needed to ascertain when a Coefficient of Determination is large or small; however, the .997 estimate obtained for model 2 is quite large.

Having examined the overall fit of the model, the question of the estimates of factor loading and measurement errors need to be addressed. That is, we investigated the component fit of model 1 and model 2.

Table 3 about here

Model 1 is examined first. As Table 3 indicates, factor loadings of the observed indicators (1 through 11) on their respective latent constructs have a magnitude greater than .390, with the largest being .932. They are all statistically significant at the .05 level. Moreover, a perusal of ζs (errors in the equations) suggest that the latent variables are independent constructs. That is, the correlations between the ζs for the four constructs are small and statistically nonsignificant.

Moving to the model with the best overall fit (model 2), Table 3 reveals that the coefficient estimates are quite similar to those based on the assumption of independent εs. The differences in parameter estimates are mostly small. Further, the estimates of the selected correlated errors are all statistically significant.

A final component measure investigated was the reliability of the indicators. Table 4 lists these estimates for each indicator.

Table 4 about here

Table 4 shows that of the three indicators of television exposure, frequency of watching television is the most reliable. For the newspaper exposure construct, frequency of reading newspaper is the most reliable, closely followed by frequency of reading the news section of the newspaper. For the radio exposure construct, frequency of listening to radio is the most reliable measure. Finally, for the magazine exposure construct, attention to magazines is the most reliable measure. It may also be observed that there is a considerable range in the magnitude of these estimates, with time spent with magazines and attention paid to nonnews radio having the lowest reliabilities.

To summarize, a number of overall and component fit measures were presented as a means of assessing the adequacy of the hypothesized confirmatory factor analyses. The fundamental question remains as to whether our multidimensional model of mass media exposure is consistent with the data. Acknowledging that there is always a large element of judgment in deciding on model fit, the evidence suggests to us the fit is quite sufficient. For example, the summary fit measures for model 2, and to a lesser degree for model 1, indicated that: (1) X^2/df was quite small for the relatively large sample size; (2) the GFI, and the Coefficient of Determination were large; (3) the AGFI, which takes into account degrees of freedom, was impressive, and (4) the CN was within acceptable boundaries. Considering the various component measures, they did not yield any obvious abnormalities. Moreover, the prediction that certain estimates would be statistically significant (e.g., λ s), and others statistically nonsignificant (e.g., correlated ζ s) received support.

Conclusions

As abstract and complex constructs, the various dimensions of mass media exposure cannot be measured simply and directly. A number of potential indicators may represent each of these dimensions. Nonetheless, each indicator is a flawed measure of its latent construct.

In our analysis, a substantial amount of information, on commonly used measures of mass media exposure, was obtained. For instance, the indicators of mass media exposure contained both random and nonrandom measurement error. Each indicator contained a considerable portion of random error, and nonrandom error was exhibited among three pairs of indicators.

An important implication of our findings is that any analysis of mass media exposure must consider measurement error. To the extent that random or nonrandom measurement error exists it can influence relational analysis. Depending on the configuration of these two types of error, it may not only affect the strength but also the direction of a relationship. (Andrews, 1984).

Ideally, a random sample of all possible indicators of the four constructs should be selected, choosing a sufficient number to reach the desired reliability. Alas, this is never the case. Although the measures used in this study are representatives of the most commonly used ones, it would have been desirable to have other indicators for each construct. A few likely candidates are: the number of magazines read regularly, the degree of dependency on the various media for various types of content and, perhaps, the frequency of reading various types of content in different types of magazines. Furthermore, additional indicators would also permit a test of mass media exposure models of greater complexity than those formulated here.

Aside from the need for additional valid indicators of the derivatives of mass media exposure, this study has argued against the nonselective use of indicators of mass media exposure. Many of the conflicting results on the impact of mass media on diverse social attitudes and behaviors are, undoubtedly, a function of this nonselectivity.

It is worth mentioning that the indicators used in this study reflect a specific definition of mass media exposure. Other definitions and conceptualizations, and there are many, may suggest quite different indicators, which might yield quite different results. In light of the proposed structure of our model, one may be inclined to construct composite scores, maybe selecting the most reliable ones, to index various dimensions. However, such an inclination should be resisted. This practice in structural equation modeling will lead to a misspecification of dimensionality and will fail to take measurement errors into account when structural parameters are estimated.

Since rarely do communication researchers estimate the measurement error in indicators of mass media exposure, our results must be interpreted with some caution. An attempt should be made to replicate these findings. Without replication we are less confident that our results generalize beyond the sample investigated. The proposed models, which have been supported empirically, should be explored across different subgroups of the population. Additionally, alternative formulations should be evaluated. It is possible that more than one model may fit the data well. Should this be the case, critical tests to evaluate validities of different specifications need to be conducted.

References

Allen, R.L. (1981). The reliability and stability of television exposure measures. Communication Research, 8, 233-256.

Allen, R.L. & Taylor, B.F. (1985). Media public affairs exposure: Issues and alternative strategies. Communication Monographs, 52, 186-201.

Andrews, F.M. (1985). Construct validity and error components of survey measures: A structural modeling approach, Public Opinion Quarterly, 48, 409-442.

Ball-Rokeach, S.J., & DeFleur, M.L. (1976). A dependency model of mass-media effects. Communication Research, 3, 3-21.

Blalock, H.M. (1982). Conceptualization and measurement in the social sciences. Beverly Hills, CA: Sage.

Bollen, K.A. (1985). Structural equations with latent variables. Unpublished manuscript.

Carmines, E.G., McIver, J.P. (1981). Analyzing models with unobserved variables: Analysis of covariance structures. In G.W. Bohrnstedt & E.F. Borgatta (Eds.), Social measurement (pp. 65-115). Beverly Hills, CA: Sage.

Chesebro, J.W. (1984). The media reality: Epistemological functions of media in cultural systems. Critical Studies in Mass Communication, 1, 111-130.

Gerbner, G. (1967). Mass media and human communication theory. In D. McQuail (Ed.), Sociology of mass communications (pp. 35-38). Harmondsworth, Mddx: Penguin.

Hoelter, J.W. (1983). The analysis of covariance structure: Goodness of fit indices, Sociological methods and research, 11, 325-44.

Jeffres, L.W. (1984). Mass media processes and effects. Prospect Heights, IL: Waveland Press, Inc.

Jöreskog, K.G. (1969). A general approach to confirmatory maximum likelihood factor analysis. Psychometrics, 34, 183-202.

Jöreskog, K.G. & Sorbom, D. (1981). Lisrel IV: Estimations of linear structural equation systems by maximum likelihood methods. Chicago: International Educational Services.

Long, J.S. (1976). Estimation and hypothesis testing in linear models containing measurement error. Sociological methods and research, 5, 157-206.

McLeod, J.M. & McDonald, D.G. (1985). Beyond simple exposure: Media orientations and their impact on political processes. Communication Research, 12, 3-33.

Miller, P.V., (1977). Themes of measurement in communication research. In P.M. Hirsch, P. Miller, & F.G. Kline (Eds.), Strategies for communication research (pp.113-126). Beverly Hills: Sage.

Miller, P.V. (1974). Issues in conceptualization and measurement of message discrimination. Unpublished manuscript.

Roberts, D.F. & Bachen C.M. (1981). Mass communication effects, Annual Review of Psychology, 32, 307-56.

Salomon, G. & Cohen, A.A. (1978). On the meaning and validity of television viewing. Human Communication Research, 4, 265-70.

Saris, W.E., dePrjper, W.M. & Zegwaart, P. (1979). Detection of specification errors in linear structural equation models. In K.F. Schuessler (Ed.), Sociological methodology (pp. 151-171). San Francisco: Jossey-Bass.

Wachtel, E. (1978). Technological cubism. The presentation of space and time in multi image. ETC., 35, 376-383.

Waksberg, J. (1978). Sampling methods for random digit dialing. Journal of the American Statistical Association, 73, 40-46.

Weaver, D. (1984, May). Media agenda-setting and public opinion: Is there a link? Paper presented at the annual conference of the International Communication Association, San Francisco.

Wheaton, B.B., Muthen, D.A. & Summers, G. (1977). Assessing reliability and stability in panel models. In D.R. Heise (Ed.), Sociological methodology (pp. 84-136). San Francisco: Jossey-Bass.

Footnotes

1. Although it was theorized that the model presented in Figure 1 would provide a good fit, we also considered two other likely contenders. First, we evaluated a second-order model with one second-order factor (mass media exposure) and with the four first-order factors (television, newspaper, radio and magazine exposure constructs). Second, we evaluated a model with two second-order factors (electronic mass media exposure and print mass media exposure) and with four first-order factors (television, newspaper, radio and magazine exposure constructs). Neither provided an adequate fit.

2. One of the pairs of correlated errors was chosen based on substantive knowledge, the other two by empirical means. Specifically, the measurement error, ε_3 associated with Y_3 (attention to nonnews television), is correlated with measurement errors of Y_9 (attention to nonnews radio). The correlated errors seem plausible because of the similarity of wording.

The other two pairs of correlated measurement errors were identified by choosing the largest first-order derivative of the likelihood function associated with the proposed model. This procedure was carried out in a stepwise fashion until two pairs of correlated errors were selected and the increment in goodness-of-fit started to level off. These two pairs of between construct correlated measurement errors were: ε_1 (time spent with television) and ε_8 (frequency of radio listening) and ε_2 and ε_5 (frequency of watching television) and (attention to newspapers). Prior theoretical knowledge was not available which would have permitted an a priori treatment of these pairs of correlated errors. Consequently, an explanation of their existence is quite

difficult. The causes and consequences of these errors need to be further explored, but it is beyond the scope of the present study.

3. The squared multiple correlation coefficient (R^2yi) was used to estimate reliabilities. It is an estimate of variance in yi explained by the variables in η. The R^2yi is defined with respect to a particular measurement model. Only those variables explicitly included in a model and which have a direct effect on yi contribute to the R^2yi. As Bollen (1985, p. 48) pointed out, unlike the traditional approach to reliability more than one latent variable can influence yi and contribute to R^2_{yi}. There is no issue of specific variance, since the R^2yi is only with respect to included variables not to those outside the system. Furthermore, correlated errors of measurement are allowed.

Table 1. Variance-Covariance Matrix of Measures of Media Exposure

Variables	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}	Y_{11}
Y_1 Time TV	7.488										
Y_2 Frequency of TV	2.629	6.689									
Y_3 Attention to nonnews TV	1.838	2.481	7.808								
Y_4 Frequency of newspapers	-.603	.714	.860	17.801							
Y_5 Attention to newspapers	.089	1.042	1.253	4.157	5.101						
Y_6 Frequency news section newspapers	-.470	-.021	.481	13.741	3.861	19.851					
Y_7 Time radio	.191	1.134	1.655	-3.320	.384	-1.770	43.084				
Y_8 Frequency radio	-1.600	.217	1.451	.986	1.544	2.580	16.820	21.578			
Y_9 Attention to nonnews radio	1.023	1.166	3.223	-1.264	1.006	-.972	6.508	6.269	13.765		
Y_{10} Time magazines	-.222	-.060	.053	.344	.821	.898	2.042	2.113	-.128	19.237	
Y_{11} Attention to magazines	-.002	-.110	.693	1.268	.614	2.848	.507	1.855	.389	4.644	9.516

Table 2. Overall Goodness-of-Fit Estimates

	Null Model	Model 1	Model 2
x^2	777.220	119.840	76.430
Degrees of freedom (df)	55	38	35
Probability	.000	.000	.000
x^2/df	14.131	3.154	2.184
Goodness-of-fit index	.700	.939	.961
Adjusted goodness-of-fit index	.650	.894	.926
Critical N	-	151	218
Coefficient of determination	-	.997	.998

Table 3. LISREL Estimates of Mass Media Exposure Model

Parameters	Model 1	Model 2
Factor loadings		
η_1: Television exposure		
Y_1: Time TV	1.000 (.500)	1.000 (.512)
Y_2: Frequency of TV	1.391 (.735)	1.220 (.661)
Y_3: Attention to nonnews	.967 (.474)	.902 (.452)
η_2: Newspaper exposure:		
Y_4: Frequency of newspaper	1.000 (.866)	1.000 (.866)
Y_5: Attention to newspaper	.298 (.486)	.300 (.353)
Y_6: Frequency news section newspaper	1.010 (.836)	1.028 (.843)
η_3: Radio exposure		
Y_7: Time radio	1.000 (.592)	1.000 (.591)
Y_8: Frequency of radio	1.114 (.932)	1.107 (.924)
Y_9: Attention to nonnews radio	.376 (.394)	.365 (.381)
η_4: Magazine exposure		
Y_{10}: Time magazines	1.000 (.406)	1.000 (.399)
Y_{11}: Attention to magazines	1.463 (.845)	1.514 (.860)
Errors in equations		
$\Psi_{1,1}$	1.872 (1.000)	1.965 (1.000)
$\Psi_{2,2}$	13.587 (1.000)	13.349 (1.000)
$\Psi_{3,3}$	15.112 (1.000)	15.033 (1.000)
$\Psi_{4,4}$	3.174*(1.000)	3.068*(1.000)
$\Psi_{2,1}$	.323*(.064)	.407*(.080)
$\Psi_{3,1}$	.185*(.035)	.492*(.091)
$\Psi_{3,2}$	1.228*(.086)	1.045*(.074)
$\Psi_{4,1}$	.035*(.014)	.075*(.031)
$\Psi_{4,2}$	1.269*(.193)	1.256*(.196)
$\Psi_{4,4}$	1.127*(.163)	1.064*(.157)
Measurement errors in indicators		
$\Theta_{1,1}$	5.616	5.452
$\Theta_{2,2}$	3.066	3.671
$\Theta_{3,3}$	6.056	6.059
$\Theta_{4,4}$	4.214	4.452
$\Theta_{5,5}$	3.899	3.905
$\Theta_{6,6}$	5.993	5.738
$\Theta_{7,7}$	27.972	28.052
$\Theta_{8,8}$	2.837	3.114
$\Theta_{9,9}$	11.624	11.521
$\Theta_{10,10}$	16.063	16.169
$\Theta_{11,11}$	2.721*	2.485*
Correlated measurement errors		
$\Theta_{5,2}$	---	.624
$\Theta_{8,1}$	---	2.046
$\Theta_{9,3}$	---	2.402

Note: All estimates are significant at $P<.05$ level except those marked *.
Standardized estimates enclosed in parentheses.
Correlated errors terms are constrained to 0 for Model 1.

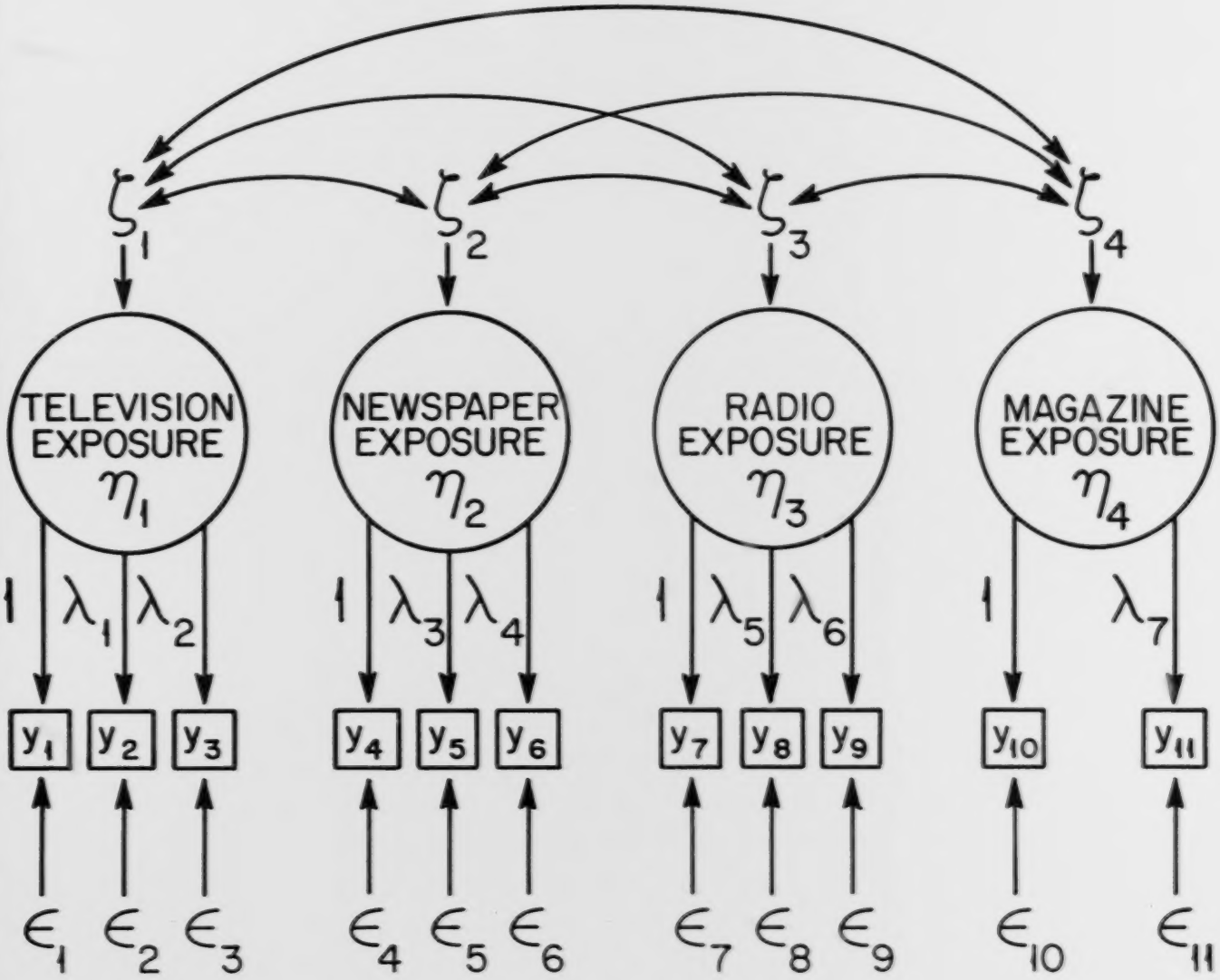
Table 4.

Estimated Reliability Coefficients
Indicators of Four Mass Media Constructs

Variables	$R^2_{y_i}$
1) Time spent with television	.272
2) Frequency of watching television	.451
3) Attention to nonnews television	.224
4) Frequency of daily newspaper reading	.750
5) Attention to front page section of newspaper	.234
6) Frequency of reading news section of paper	.711
7) Time spent with radio	.349
8) Frequency of radio listening	.856
9) Attention to nonnews radio	.163
10) Time spent with magazines	.159
11) Attention to magazines	.739

Figure Captions

Figure 1. The Multidimensional Structure of Mass Media Exposure.


ζ1
ζ2
ζ3
ζ4
TELEVISION EXPOSURE
η1
NEWSPAPER EXPOSURE
η2
RADIO EXPOSURE
η3
MAGAZINE EXPOSURE
η4
1
λ1
λ2
1
λ3
λ4
1
λ5
λ6
1
λ7
y1
y2
y3
y4
y5
y6
y7
y8
y9
y10
y11
ε1
ε2
ε3
ε4
ε5
ε6
ε7
ε8
ε9
ε10
ε11